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THE OCCURRENCE OF *AZOLLA FILICULOIDES* L. AND ASSOCIATED VASCULAR PLANTS IN A QUATERNARY DEPOSIT IN MELBOURNE, AUSTRALIA

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Abstract

The discovery of megaspores and massulae of *Azolla filiculoides* L. in material from a Quaternary deposit in Melbourne is reported. An account of fossil pollen grains and spores from this deposit is given. From the evidence provided by these plant microfossils, it appears probable that the climate during the formation of the deposit was somewhat wetter and cooler than it is at the present day.

Introduction

Material from several bores put down by the Country Roads Board in Quaternary deposits near the River Yarra at King Street and at Spencer Street, Melbourne, recently became available for palynological examination. Abundant pollen grains and spores were observed in a number of samples, and remains of *Azolla filiculoides* L. were found in two of them.

The exact level represented by most of the samples is not known, as they were selected at random from fairly long pieces of bore core. In addition, they come from six different bores, and only two of them are consecutive. Hence the results of this investigation, although providing some information regarding the plants which grew in the vicinity of the deposit during its formation, do not give a complete picture of the vegetational and other changes which took place at this time. However, it is considered that these results merit publication because palynological information regarding such deposits in Australia is very sparse and because the record of *A. filiculoides* may be of some importance. It is hoped that a more detailed examination of a bore in this area may be possible at some future date.

Material

The material on which this study has been based consists of mud containing a variable quantity of coarse organic matter. Only one sample from the bores put down in the vicinity of Spencer Street was available. This bore was close to the Spencer Street bridge. The sample yielded abundant pollen grains and spores, which were first examined by Miss K. Pike (see Willis 1955) and which have now been studied in greater detail. The material was associated with a piece of red gum wood* recovered from a depth of 63 feet below the present low water mark. Using radiocarbon methods, the United States Geological Survey Laboratories estimated the age of this wood to be 8780 ± 200 years (Gill 1955).

Twelve samples from bores in the King Street area were examined. Of these, only the following contained large numbers of pollen grains and spores (the figures represent depth below sea level):

* This wood was recorded as red gum by Gill (1955) and Willis (1955). Mr. R. Ingle (Forest Products Division, C.S.I.R.O.), who identified the wood, stated in a personal communication that it is probably *Eucalyptus camaldulensis* Dehnh., but that its structure does not enable him to be absolutely certain of this identification.

B.6. 1-9′, 55-56′ (the upper limit of this sample is one foot above sea level)
B.12. 57-68′
B.19. 52-62′, 62-65′, 74-86′

The sample B.24 121′ contained so few pollen grains and spores that they could not be satisfactorily compared with those from the samples listed above. No recognizable plant microfossils were observed in the remaining samples, which were as follows:

B.6. 125-130′
B.19. 112-120′
B.21. 112-119′ 6″, 122-127′
B.24. 109′

Mr. E. D. Gill, of the National Museum of Victoria, considers that the King Street samples which come from depths comparable with the red gum wood from the Spencer Street bore may reasonably be supposed to be of similar age.

Methods

The chlorination-acetolysis technique (Erdtman 1943) was used when making slides for the examination of fossil pollen grains and spores. For the recovery of megaspores and massulae of *Azolla,* the following procedure was adopted. A small portion of a sample was boiled in 10% sodium hydroxide and passed through a sieve with meshes approximately 0·15 mm. square. The debris retained on the sieve was washed with water, transferred to water in a Petri dish and examined under a high power dissecting microscope. Any megaspores and massulae which were observed were then removed with a small pipette, warmed in lactophenol and mounted in glycerine jelly.

Azolla filiculoides L. var. **rubra** (R. Br.) Strasburger

Samples B.12 57-68′ and B.19 62-65′ yielded megaspores and massulae which can be referred confidently to the genus *Azolla*. These organs are shown in Pl. I. The megaspores have three "floats" and glochidia are present on the massulae, so that the fossils must belong to the subgenus *Euazolla* Meyen (Baker 1886). This subgenus consists of four species, *A. caroliniana* Willd., *A. filiculoides* L., *A. mexicana* Presl. and *A. microphylla* Kaulfuss. Published descriptions of the megaspores and massulae of these species (Strasburger 1873, Baker 1886, Campbell 1873, Svenson 1944 and West 1953) show that the fossils match the corresponding organs of *A. filiculoides* and are different from those of the other three species. The lower halves of the megaspores of the fossils and of *A. filiculoides* have prominent, rounded tubercles, while those of *A. mexicana* are pitted and those of *A. microphylla* smooth. The megaspores of *A. caroliniana* have not been described. The glochidia of the fossil massulae are two-barbed and are usually septate for about a third of their length although, as shown in Fig. 1, the septation is sometimes more extensive and may reach the base. The glochidia of *A. filiculoides* are two-barbed and, if any septa are present, they are usually confined to the distal portions of the glochidia. The glochidia of *A. mexicana* and *A. microphylla,* which are also two-barbed, are regularly septate over their entire length, and those of *A. caroliniana,* which show incomplete terminal septation, have 1-4 barbs. Thus the structure of the fossils provides a satisfactory basis for their identification as *A. filiculoides,* and this identification is confirmed by the evidence from the present day distribution of the species which belong to the subgenus *Euazolla. A. filiculoides* is the only one of the species which is now native to Australia and, as the deposit which yielded the fossils appears to be relatively recent, it is unlikely that either an extinct or an alien species is represented.

It is generally believed that the only form of *A. filiculoides* which occurs in Australia is var. *rubra,* but the status of this variety seems to be open to doubt. Differences in the septation of the glochidia form the basis for the separation of the variety from the species, but there is no uniformity of opinion regarding the exact line of demarcation between the two. Strasburger (1873), Baker (1886) and

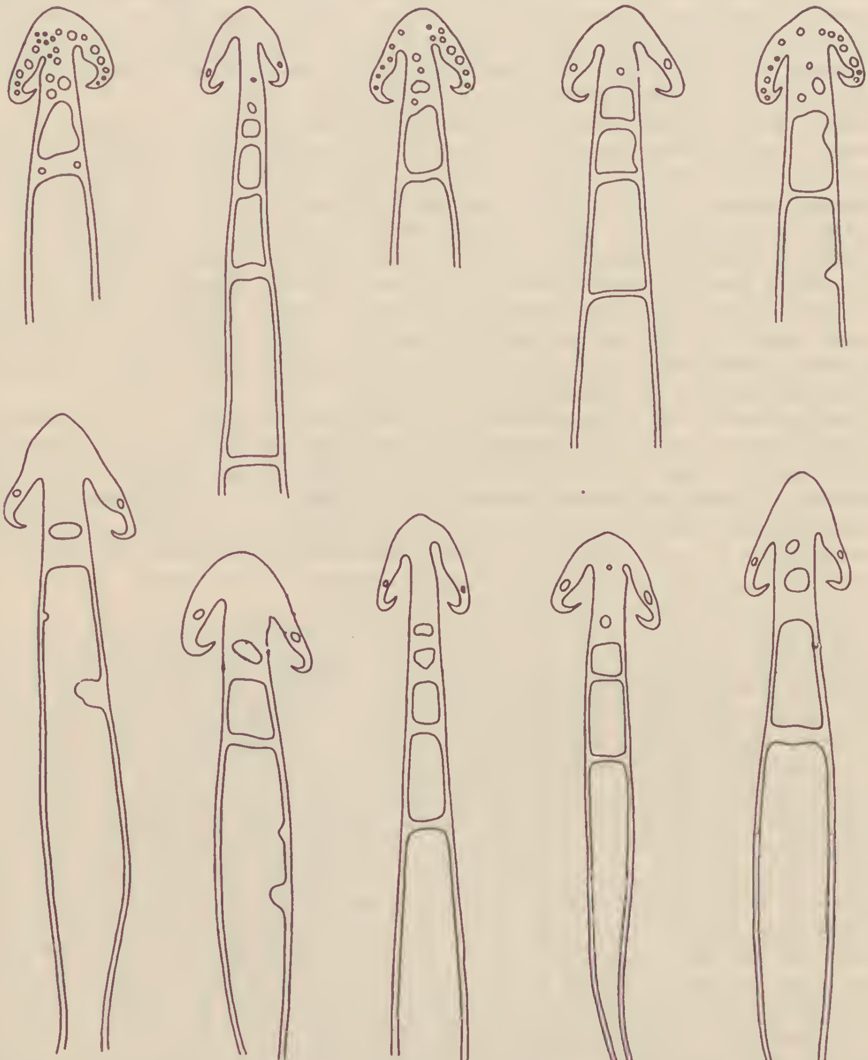

FIG. 1.—Glochidia from fossil massulae of *Azolla filiculoides* var. *rubra* from B. 12, 57-68′ and B. 19, 62-65′ × c. 1050.

Svenson (1944) state that the glochidia of *A. filiculoides* are non-septate while those of var. *rubra* are septate at the apex. However, Campbell (1893), who does not mention the variety, considers that the glochidia of *A. filiculoides*, although usually non-septate, may show one or two septa towards the tips, and West (1953) believes that they show "regular terminal septation". West states that the glochidia of var. *rubra* have 1-4 extra septa at their distal ends. He also points out that, in fossil material which he refers to *A. filiculoides*, a single massula may show some glochidia with terminal septation and others in which the septa extend further back along the stalk. Similar variations in the glochidia of individual massulae have been observed in herbarium specimens of var. *rubra* obtained from Bayswater, Western Australia, during the present studies. Most of the glochidia on each of these massulae are septate for about a third to a half the length of the stalk, but some are septate almost to the base and there may be a few non-septate ones.

There do not appear to be any other differences between the species and the variety. In spite of the fact that var. *rubra* was originally described as a distinct species, *A. rubra* R. Br. (Brown 1810), the descriptions do not mention any differences between the vegetative parts of *A. filiculoides* and those of var. *rubra*. Strasburger suggested that the tubercles on the megaspores of the species tend to be more confluent than those of the variety, but this trend has not been observed in any of the material examined by the present authors. Finally, it may be noted that, although, according to Strasburger, var. *rubra* is confined to Australasia (a view that has been perpetuated by Bentham (1878) and Ewart (1930)), Svenson considers that the variety is scattered throughout the range of the species in America and is of little geographcial importance.

Thus, as far as can be determined, the distinction between *A. filiculoides* and *A. filiculoides* var. *rubra* is based merely on the number of septa in the glochidia, and this number may vary in the different glochidia of one massula. This is an unsatisfactory basis for the establishment of a variety, and it seems probable that the variety should be suppressed. However, the variety, as it occurs in Australia, is recognizable as such, and the present authors consider that they have not examined enough material to enable them to suppress it. The fossils are therefore recorded as *A. filiculoides* var. *rubra*.

The discovery of fossil remains which can be referred to *A. filiculoides* is of botanical interest, and recent work in Europe suggests that it may be of some importance stratigraphically. Pollen analyses of a Mindel-Riss Interglacial deposit at Hoxne, Suffolk (West 1956), and of the Günz-Mindel Interglacial deposits of the Cromer Forest Bed of the Norfolk coast (S. L. Duigan unpub.), have shown that *A. filiculoides* occurs only in certain horizons in these deposits. This fact is of value in zoning the deposits. Although the King Street samples are not sufficiently comprehensive to give any exact information regarding the vertical distribution of *A. filiculoides*, there is some evidence that it occurs only in a limited part of the deposit. Massulae and detached glochidia are common in slides prepared from B.12 57-68′ and B.19 62-65′, but are not found at all in samples representing positions just above (B.6 55-56′, B.19 52-62′) and below (B.19 74-86′) these or in any of the other samples. Bore 19 is thus of particular interest, as it shows an almost continuous series of samples which seem to set fairly narrow limits to the occurrence of *A. filiculoides*. Although it is obvious that no definite hypothesis can be formed until more detailed work has been done, it can be seen that *A. filiculoides* may be of importance in the pollen analytical or chronological subdivision of deposits of this type in Victoria. It is unfortunate that the material associated with the fossil red gum wood, which is of known age, yielded no remains of *A. filiculoides*.

In addition to the English sites mentioned, *A. filiculoides* has been found in Quaternary deposits at other localities in England (West 1953), the Netherlands (Florschütz 1938, 1945, van der Vlerk and Florschütz 1950, 1953), Germany (Florschütz 1941, von Rochow 1952, Hiltermann 1954) and the U.S.S.R. (Nikitin 1953). It is of particular interest to note that van der Vlerk and Florschütz consider that the early subdivisions of the Quaternary period can be identified by the species of *Azolla* which are present in any given deposit in the Netherlands. They believe that the genus was represented only by *A. filiculoides* in the Needian (usually considered to be the equivalent of the Mindel-Riss Interglacial), by both *A. filiculoides* and *A. tegeliensis* Florsch. in the Taxandrian and by *A. tegeliensis* alone in the Tiglian. Although there is some evidence which suggests that these limits to *Azolla* may not be the same in countries outside the Netherlands, it is clear that the distribution of *Azolla* in early to middle Quaternary deposits is of considerable stratigraphic importance in Europe. The fact that *A. filiculoides* has now been found as a fossil in Australia suggests that it may, in the future, be of some value in the separation of the major divisions of the Quaternary period in this country, although there is the obvious complication that *A. filiculoides* is still native to Australia whereas it was not re-introduced into Europe until 1880 (Marsh 1914).

West (1953) discusses the present day ecology and distribution of *A. filiculoides*, and from this account it appears that the exact conditions governing its distribution are not known. It is in general a plant of temperate regions, although it does grow as far north as Alaska. The available evidence from interglacial deposits suggests that, in England, it was confined to the warmer parts of interglacial periods. On the whole, it appears probable that the horizons of the River Yarra deposit which have yielded *A. filiculoides* were laid down during a period when the climate was temperate and without severe winters. Its apparent disappearance from higher levels may indicate climatic change but could instead have been caused by changes in the speed or course of the river, as *A. filiculoides* usually grows only in relatively quiet water. Although *A. filiculoides* still occurs in the vicinity of Melbourne, it is not known to occur on the River Yarra at the present day.

Pollen grains and spores

In the various samples examined, the only pollen which could be referred directly to a living species was that of *Nothofagus cunninghamii* Oerst. However, the fact that it was impossible to identify the species of the other plants which produced the pollen in this deposit is undoubtedly due to difficulties of identification rather than to the presence of extinct or alien species. Four types of spore which were found are considered to be identical with those of existing Victorian species. Pl. II shows fossil spores referred to *Cyathea australis* (R. Br.) Domin, *Dicksonia australis* Labill., *Phymatodes diversifolium* (Willd.) Pic.-Serm. and *Todea barbara* Moore, and also spores from living plants of these species. A small number of fossil pollen grains has been identified as *Banksia* sp. As pointed out by Cookson (1950), the pollen of this genus is indistinguishable from that of the Western Australian genus *Dryandra*, but as it seems most unlikely that the latter was represented in Victoria at the time when this deposit was laid down, the pollen has been referred to *Banksia*.

Pollen grains of *Acacia* sp., *Casuarina* sp. and *Nothofagus cunninghamii* and spores of *Dicksonia antarctica* and *Phymatodes diversifolium* were found in all the King Street samples previously listed as containing abundant plant microfossils. Other pollen grains which occur in all these samples could only be referred to families; these are the families Compositae (pollen of the type found in *Senecio* etc.), Myrtaceae (probably including *Eucalyptus* and several other genera) and Gramineae. Spores which belong to the Filicales, but which could not be identified further, were also found in all of these samples. Pollen of the Chenopodiaceae was absent from only one of these samples (B.19 52-62′), and *Banksia* sp. was recorded from all but B.6 1-9′ and B.19 62-65′. With the exception of the *Banksia* pollen, all these pollen grains and spores were also noted in the material from the Spencer Street bridge site.

Spores and pollen grains which were present in reasonable numbers in two or three of the King Street samples are those of *Azolla filiculoides* (Pl. I, figs. 7, 8), *Dicksonia antarctica*, *Cyathea australis*, *Todea barbara*, *Haloragis* sp., *Myriophyllum* sp., *Plantago* sp. and of the family Cyperaceae. Of these, only *Azolla*, *Myriophyllum* and the Cyperaceae were not recorded from the Spencer Street sample.

In some instances, identifications were made on the basis of a single pollen grain of each particular type. These are recorded here for the sake of completeness but, owing to the possibility that they may represent contamination, the records are in need of confirmation. Pollen in this group includes that of *Lavatera* sp. (apparently not *L. plebeja* Sims., the only Victorian species), *Polygonum* sp. (pollen of the type found in *P. persicaria* L., but not restricted to that species), *Sparganium* sp., Compositae (of the type found in *Microseris*, *Taraxacum*, etc.) and Geraniaceae. None of these was found in the material from the Spencer Street site. The only plant microfossils which were found there but not in any of the other samples were pollen grains of the Compositae (of the type shown by *Ambrosia maritima* L.) and Caryophyllaceae.

Small numbers of the alga *Botryococcus braunii* Kützing were observed in one sample (B.12 57-68′).

The only type of pollen grains which was recorded but which has been omitted from the above lists is one which can be identified, in the sense that it can be given a name, but which cannot be referred to any specific group of modern plants. This is *Triorites harrisii* Couper, first described by Couper (1953) for New Zealand, but since recorded from many Tertiary deposits in Australia by Cookson and Pike (1954). It was found in several of the King Street samples and also in the Spencer Street sample. While the nature of the plant which produced this pollen is still unknown, the fact that it grew near the Yarra relatively recently suggests that it probably still grows in Australia.

It is of interest to consider whether the recorded microfossils give any indications of the climatic conditions under which the deposit was laid down. The presence of spores of the tree-ferns *Cyathea australis*, *Dicksonia antarctica* and *Todea barbara* and of other ferns suggests a somewhat wetter climate than that prevailing at the present day. Two hundred pollen grains and spores were counted from each of the samples B.6 55-56′ and B.19 62-65′, and the counts showed *Dicksonia antarctica* 5% and 4%, *Todea barbara* 1% and 0%, *Phymatodes diversifolium* 1% and 1%, other ferns (excluding *Azolla*) 5% and 8% and total fern spores (excluding *Azolla*) 12% and 13% respectively. The fact that these figures are quite high and that *Dicksonia*, *Phymatodes*, and other ferns have been recorded from all samples suggests that the presence of the spores is probably not due to long-distance transport. However, in the absence of information regarding the present day occurrence of these types of fern spore in the atmosphere of Melbourne, this point cannot be regarded as proved beyond question. It is also true that, although fern gullies usually occur in areas with a slightly higher rainfall than Melbourne has now, tree ferns are influenced by the level of the water table, so that swampy conditions around the River Yarra may have led to their occurrence there.

The presence of the pollen of *Nothofagus cunninghamii* suggests that the climate may also have been slightly colder than that of the present day. The samples mentioned above showed 2% and 1% respectively of this pollen. These figures are rather low, and the possibility of long-distance transport cannot be excluded. However, the fact that the values are even as high as 2% and that pollen of this species was present in all samples suggests that it is unlikely to have come from a very great distance. At the present day, beech is found in the ranges to the north-east of Melbourne, and the nearest stand is some 35 miles away.

Willis (1955), who also examined the material associated with the red gum wood from the Spencer Street site, found leaves of *Sphagnum cristatum* Hpe. in it. This moss is an alpine or sub-alpine plant, and its presence, together with the fact that beech pollen and spores of tree-ferns had been previously observed in this material by Miss K. Pike, led Willis to the conclusion that the climate during the formation of this part of the deposit was much wetter and cooler than that of the present day.

It is obvious that the pollen grains and spores which have been recorded are the product of a mixture of communities. As the species of most of the plants which produced these pollen grains and spores are not known, the communities cannot be satisfactorily identified. It is probable that the tree-ferns, possibly with *Nothofagus cunninghamii,* occupied the wetter habitats, while *Casuarina* and *Banksia* may have grown in the areas with better drainage. There are, of course, some Victorian species of *Casuarina* and *Banksia* which grow in swamps, so that the position of these genera during the formation of the deposit is not certain. Red gum probably grew along the river banks, and could have been accompanied by most of the herbs which have been identified, while *Azolla* and *Myriophyllum* doubtless grew in the water.

Even in cases where pollen counts were made, there is no definite evidence as to the relative abundance of the plants which produced the pollen. However, the fact that pollen of the Myrtaceae reaches 48% in B.6 60-61′ and 51% in B.19 67-70′ suggests that this family was strongly represented in the immediate vicinity of the deposit. Insect pollination is the rule in this family, and hence the pollen is unlikely to have come from plants growing very far away. On the other hand, the low values for *Nothofagus cunninghamii,* which is wind-pollinated, may indicate either a small number of trees or a fairly distant stand. These suggestions can only be of the most tentative kind, as the amount of pollen recorded is dependent on the quantity of pollen produced by one plant of the species in question as well as on the number of plants present, their distance from the site and their method of pollination.

Conclusions

From the matters which have been discussed, it can be seen that, although the evidence is far from complete and is open to more than one interpretation, studies of the pollen grains and spores and of the reproductive organs of *Azolla filiculoides* from deposits in the neighbourhood of the River Yarra in Melbourne do give an indication of the conditions which probably prevailed there some 8,000-9,000 years ago and which may have persisted into much more recent times. The pollen grains and spores on which the suggestions regarding the flora and climate are based occur at depths of between 1 foot above and 86 feet below sea level, and this depth of material can scarcely have been deposited in a short time.

It appears probable that the climate of the period during which this deposit was laid down was somewhat wetter and colder than that of the present day, although it is unlikely that the winters were very severe. Plant communities characterised by either tree-ferns, *Nothofagus cunninghamii,* various genera of the Myrtaceae or *Casuarina* (possibly with *Banksia*) grew in the area at that time, and there is evidence of a moderately abundant and varied herbaceous flora. Some change in the climate or in the structure of the river appears to have taken place at the point which marks the disappearance of *Azolla,* and it is considered that this plant, which has been identified as *A. filiculoides* var. *rubra,* may be of value in zoning the deposit and that its presence may also have wider implications.

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References

Baker, J. G., 1886. A synopsis of the Rhizocarpeae. *J. Bot.,* 24; 97.

Bentham, G., 1878. *Flora Australiensis,* Vol. VII, London.

Brown, R., 1810. *Prodromus Florae Novae Hollandiae et Insulae Van-Dieman,* London.

Campbell, D. H., 1893. On the development of *Azolla filiculoides* (Lam.). *Ann. Bot.,* 7; 155.

Cookson, Isabel C., 1950. Fossil pollen grains of proteaceous type from Tertiary deposits in Australia. *Aust. J. Sci. Res.,* B 3; 166.

———, and Pike, Kathleen M., 1954. Some dicotyledonous pollen types from Cainozoic deposits in the Australian region. *Aust. J. Bot.,* 1; 197.

Couper, R. A., 1953. Upper Mesozoic and Cainozoic spores and pollen grains from New Zealand. *N.Z. Geol. Surv. Pal. Bull.* (24); 5.

Erdtman, G., 1943. *An Introduction to Pollen Analysis.* Waltham, Mass.

Ewart, A. J., 1930. *Flora of Victoria.* Melbourne.

Florschütz, F., 1938. Die beiden *Azolla*-Arten des Niederländischen Pleistozäns. *Rec. Trav. bot. neerl.,* 35; 932.

———, 1941. *Azolla filiculoides* Lam. uit de Paludina-klei van Berlijn. *Proc. Acad. Sci. Amst.,* 44; 339.

———, 1945. *Azolla* uit het Nederlandsche Palaeoceen en Pleistoceen. *Verh. geol-minjb. Genoot. Ned. Kolon.,* 14; 191.

Gill, E. D., 1955. Radiocarbon dates for Australian archaeological and geological samples. *Aust. J. Sci.,* 18; 49.

Hiltermann, H., 1954. Neue Funde von *Azolla* im Pleistozän Deutschlands. *Geol. Jber.,* 68.

Marsh, A. S., 1914. The history of the occurrence of *Azolla* in the British Isles and in Europe generally. *Proc. Camb. Phil. Soc.,* 17; 383.

Nikitin, P. A., 1933. The Quarternary flora of the Lower Volga region. (Russian.) *Trav. Comm. Quatern. Acad. Sci., U.R.S.S.,* 3.

von Rochow, Margita, 1952. *Azolla filiculoides* im Interglazial von Wunstorf bei Hannover und das wahrscheinliche Alter dieses Interglazials. *Ber. dtsch. bot. Ges.,* 45; 315.

Strasburger, E., 1873. *Ueber Azolla.* Jena.

Svenson, H. K., 1944. The New World species of *Azolla. Amer. Fern J.,* 34; 69.

van der Vlerk, I. M., and Florschutz, F., 1950. *Nederland in het Ijstijdvak.* Utrecht.

———, 1953. The palaeontological base of the subdivision of the Pleistocene in the Netherlands. *Verh. Kon. Akad. v. Wet., afd. Natuurk.,* ie reeks, part 20; 2.

West, R. G., 1953. The occurrence of *Azolla* in British interglacial deposits. *New Phyt.,* 52; 267.

———, 1956. The Quarternary deposits at Hoxne, Suffolk. *Phil. Trans. Roy. Soc.,* 239; 265.

Willis, J. H., 1955. Some further notes on *Sphagnum. Vic. Nat.,* 71; 189.

Explanation of Plates

All the figures are from untouched negatives

Plate I

Azolla filiculoides var. *rubra*

Fig. 1.—A megaspore. B. 12. 57-68′. × c. 150. P. 16726.*
Figs. 2, 3.—Surface of the same megaspore. × c. 800. Fig. 2 at high focus; Fig. 3 at low focus.
Fig. 4.—Portion of a massula. B. 19. 62-65′. × c. 300. P. 16727.
Fig. 5.—An entire massula. B. 19. 62-65′. × c. 200. P. 16728.
Fig. 6.—A single glochidium. × c. 800.
Figs. 7, 8.—Microspores. B. 12. 57-68′. × c. 800. P. 16729.

Plate II

Fig. 1.—Spore from a living specimen of *Dicksonia antarctica* Labill. × c. 600.
Fig. 2.—Fossil spore of *D. antarctica*. B. 19. 74-86′. × c. 600. P. 16730.
Fig. 3.—Fossil spore of *Cyathea australis* (R. Br.) Domin. B. 6. 55-56′. × c. 600. P. 16832.
Figs. 4, 5.—Spores from a living specimen of *C. australis*. × c. 600.
Figs. 6, 7.—High focus and optical section of a fossil spore of *Todea barbara* Moore. B. 6. 1-9′. × c. 600. P. 16833.
Figs. 8, 9.—High focus and optical section of a spore from a living specimen of *T. barbara*. × c. 600.
Fig. 10.—Fossil spore of *Phymatodes diversifolium* (Willd.) Pic.-Serm. B. 6, 55-56′ × c. 600. P. 16834.
Fig. 11.—Spore from a living specimen of *P. diversifolium*. × c. 600.
Fig. 12.—Spore from a living specimen of *P. scandens* (Forst.) Presl. × c. 600.

* References so given are the registered numbers in the Paleontological Collection of the National Museum of Victoria.